

WHAT IS CLAIMED IS:

1. A flow device comprising:
  - (a) a housing comprising a housing chamber,
  - 5 (b) an opening in said housing adapted for insertion of a support into said housing chamber,
  - (c) a sealing member movably mounted in said housing chamber and adapted to engage said support to form a reagent chamber between a surface of said support and a surface of said sealing member,
  - 10 (d) a mechanism for moving said sealing member within said housing chamber,
  - (e) an inlet in fluid communication with said reagent chamber and
  - (f) an outlet in fluid communication with said reagent chamber.
- 15 2. A device according to Claim 1 further comprising a viewing area in a wall of said housing adapted to view a surface of said support.
3. A device according to Claim 1 wherein said viewing area is a window in a wall of said housing.
- 20 4. A device according to Claim 3 further comprising a mechanism adapted to engage said support on a surface opposite said surface engaged by said sealing member.
- 25 5. A device according to Claim 4 wherein said mechanism adapted to engage said support comprises two to four pressure-activated cylinders, each of which is disposed in a port in said window.
6. A device according to Claim 1 wherein said support is engaged by a  
30 holding element and said opening in said housing is adapted to receive said support secured by said holding element.
7. A device according to Claim 6 wherein said holding element is a vacuum actuated element.

8. A device according to Claim 6 wherein said holding element is part of a robotic arm.

9. A device according to Claim 1 further comprising a pressure-activated  
5 mechanism to which said sealing member is attached.

10. A device according to Claim 9 wherein said pressure-activated mechanism is a pressure-activated cylinder.

10 11. A device according to Claim 10 wherein said cylinder further comprises a guide.

12. A flow device comprising:

- (a) a housing comprising a housing chamber,
- 15 (b) an opening in said housing adapted for insertion of a holding element comprising a support into said housing chamber,
- (c) a sealing member movably mounted in said housing chamber and adapted to engage said support to form a reagent chamber between a surface of said support and a surface of said sealing member, wherein said sealing member is attached  
20 to a pressure-activated mechanism for moving said sealing member within said housing chamber,
- (d) a mechanism adapted to engage said support on a surface opposite said surface engaged by said sealing member,
- (e) an inlet in fluid communication with said reagent chamber,
- 25 (f) an outlet in fluid communication with said reagent chamber, and
- (g) a viewing area in a wall of said housing adapted to view a surface of said support.

13. A device according to Claim 12 wherein said viewing area is a window  
30 in a wall of said housing.

14. A device according to Claim 12 wherein said mechanism adapted to engage said support on a surface opposite said surface engaged by said sealing member

comprises two to four pressure-activated cylinders, each of which is disposed in a port in said window.

15        15.     A device according to Claim 14 wherein said holding element is a vacuum actuated element.

16.     A device according to Claim 15 wherein said holding element is part of a robotic arm.

10        17.     A device according to Claim 12 said pressure-activated mechanism is a pressure-activated cylinder within a guide.

18.     A device according to Claim 12 wherein said device is rotatably mounted on a frame.

15        19.     A method for performing a step of a chemical reaction on the surface of a support, said method comprising:

- (a)     placing a support into a chamber of a device, said device comprising:
  - (i)     a housing comprising a housing chamber,
  - 20        (ii)    an opening in said housing adapted for insertion of a holding element comprising a support into said housing chamber,
  - (iii)   a sealing member movably mounted in said housing chamber and adapted to engage said support to form a reagent chamber between a surface of said support and a surface of said sealing member, wherein said sealing member is attached
  - 25        to a pressure-activated mechanism for moving said sealing member within said housing chamber,
  - (iv)    a mechanism adapted to engage said support on a surface opposite said surface engaged by said sealing member,
  - (v)     an inlet in fluid communication with said reagent chamber,
  - 30        (vi)    an outlet in fluid communication with said reagent chamber, and
  - (vii)   a viewing area in a wall of said housing adapted to view a surface of said support;
- (b)     activating said mechanism of (iv) to urge said support toward said sealing member,

(c) activating said pressure-activated mechanism of (iii) to urge said support against said mechanism of (iv) and against an interior wall of said housing chamber and to thereby form said reagent chamber,

5 (d) introducing a fluid reagent for conducting said reaction step into said reagent chamber by means of said inlet,

(e) removing said fluid reagent from said reagent chamber by means of said outlet,

(f) deactivating said pressure-activated mechanism, and

(g) removing said support from said housing chamber.

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20. A method according to Claim 19 wherein said chemical reaction is selected from the group consisting of washing said surface, oxidizing a substance attached to said surface, removing a protecting group from a substance on said surface, blocking and deblocking sites on said surface and reducing a substance attached to said surface.

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21. A method according to Claim 19 wherein said viewing area is a window in a wall of said housing and said method further comprises viewing said surface of said support to determine the status of said step of said chemical reaction.

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22. A method according to Claim 21 wherein said mechanism of (iv) comprises two to four pressure-activated cylinders, each of which is disposed in a port in said window.

25 23. A method according to Claim 19 wherein said holding element is a vacuum actuated element and said method further comprises actuating said element to thereby secure said support to said element.

30 24. A method according to Claim 19 wherein said pressure-activated mechanism of (iii) is a pressure-activated cylinder within a guide.

25. A method according to Claim 19 wherein said device is rotatably mounted on a frame and said method comprises rotating said device 45 degrees after introduction of said fluid reagent in step (d).

26. A method for performing a step of a chemical reaction on the surface of a support, said method comprising:

- (a) placing a support into a chamber of a device,
- (b) activating a mechanism adapted to engage said support on a surface  
5 thereof,
- (c) activating a pressure-activated mechanism for moving a sealing member within said chamber to engage a surface of said support opposite said surface engaged by said mechanism of step (b) and deactivating said mechanism of step (b) to thereby form a reagent chamber,
- 10 (d) introducing a fluid reagent for conducting said reaction step into said reagent chamber,
- (e) removing said fluid reagent from said reagent chamber,
- (f) deactivating said pressure-activated mechanism, and
- (g) removing said support from said chamber.

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27. A method according to Claim 26 wherein said chemical reaction is selected from the group consisting of washing said surface, oxidizing a substance attached to said surface, removing a protecting group from a substance on said surface, blocking and deblocking sites on said surface and reducing a substance attached to said  
20 surface.

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28. A method according to Claim 26 wherein said device is rotatably mounted on a frame and said method comprises rotating said device about 20 to about 45 degrees after introduction of said fluid reagent in step (d).

29. A method for synthesizing a plurality of biopolymers on the surface of a support wherein said synthesis comprises a plurality of monomer additions, said method comprising after each of said monomer additions:

- (a) placing said support into a chamber of a first device according to Claim 1  
30 and subjecting said surface to a first step of said synthesis that is subsequent to a monomer addition and
- (b) placing said support into a chamber of a second device according to Claim 1 and subjecting said surface to a second step of said synthesis that is subsequent to said first step.

30. A method according to Claim 29 wherein each of said first step and said second step comprises a wash.

31. A method according to Claim 29 wherein said biopolymers are  
5 polynucleotides.

32. A method according to Claim 31 wherein said first step comprises subjecting said surface to an oxidizing agent.

10 33. A method according to Claim 31 wherein said second step comprises subjecting said surface to an agent for removing a protecting group.

34. A method according to Claim 29 wherein a wash solution and a reagent for said synthesis are independently directed to said inlet of said device.

15 35. A method according to Claim 34 wherein said wash solution is an organic solvent.

36. A method according to Claim 35 wherein said biopolymers are  
20 synthesized on said surface in an array.

37. A method according to Claim 36 wherein said biopolymers are synthesized on said surface in multiple arrays and said support is subsequently diced into individual arrays of biopolymers on a support.

25 38. An apparatus for synthesizing an array of biopolymers on the surface of a support, said apparatus comprising:

- (a) a plurality of devices according to Claim 1 rotatably mounted on said apparatus,
- 30 (b) one or more fluid dispensing stations in fluid communication with one or more of said devices,
- (c) a station for monomer addition to said surface of said support,
- (d) a mechanism, comprising said holding element, for moving a support to and from said station for monomer addition and one of said devices and from one of

said devices to another of said devices, and

- (e) a mechanism for rotating said devices.

5           39. An apparatus according to Claim 38 further comprising a controller for controlling the movement of said mechanism for moving said support.

          40. An apparatus according to Claim 38 wherein said mechanism is a robotic arm.

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          41. An apparatus according to Claim 38 wherein said apparatus further comprises a manifold in fluid communication with an inlet of one of said devices.

          42. A flow device comprising:

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(a) a sealing member adapted for sealing engagement with a support to form a reagent chamber *in situ*,

(b) an inlet in fluid communication with said reagent chamber, and

(c) an outlet in fluid communication with said reagent chamber.

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          43. A method for performing a step of a chemical reaction on the surface of a support, said method comprising:

(a) forming a reaction chamber *in situ*, said reaction chamber comprising said surface of said support and a sealing member,

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(b) introducing a fluid reagent for conducting said reaction step into said reagent chamber,

(c) removing said fluid reagent from said reagent chamber, and

(d) removing said support from contact with said sealing member to thereby un-form said reaction chamber.

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          44. A flow device comprising:

(a) a housing comprising a housing chamber,

(b) an opening in said housing adapted for insertion of a support into said housing chamber,

(c) a sealing member movably mounted in said housing chamber and adapted to engage said support to form a reagent chamber between a surface of said support and a surface of said sealing member,

5 (d) a mechanism for moving said sealing member within said housing chamber,

(e) an inlet in fluid communication with said reagent chamber,

(f) an outlet in fluid communication with said reagent chamber, and

(g) a viewing area in a wall of said housing adapted to view a surface of said support.

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44. A device according to Claim 43 wherein said viewing area is a window in a wall of said housing.

45. A device for transferring a support from one flow cell to another flow cell, said device comprising:

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(a) a vacuum actuated element for holding said support and

(b) a mechanism for moving the vacuum actuated element from one flow cell to another flow.

20 46. A device according to claim 45 wherein the vacuum actuated element comprises at least two prongs.

47. A device according to claim 45 wherein the mechanism is part of a robotic arm.

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48. A method for synthesizing an array of biopolymers on a surface of a support, said method comprising:

(a) adding one or more polymer subunits at each of multiple feature locations during each of multiple rounds of subunit additions and

30 (b) between rounds of subunit additions:

(i) forming a reaction chamber comprising said surface of said support and a member which seals against said surface,

(ii) introducing a fluid reagent for conducting said reaction step into said reagent chamber, and



(iii) removing said fluid reagent from said reagent chamber.

49. A method according to claim 48 additionally comprising removing said  
support from contact with said sealing member to thereby un-form said reaction  
5 chamber.

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